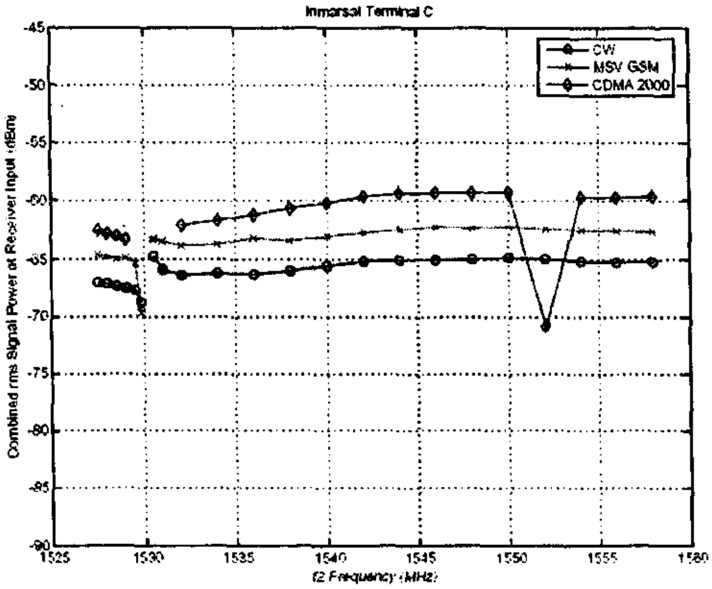

Figure 9: Inmarsat Terminal C Third-Order Intermodulation Product Harmful Interference

3.14. Inmarsat Terminal D

3.14.1. Inmarsat Terminal D is a land-mobile Inmarsat MET, designed to be mounted on the roof of a motor vehicle. It is derived from its manufacturer's similar Inmarsat Fleet 55 MET. Terminal D has two connections between its Duplexer + LNA Block and its antenna, necessitating a minor modification to the test setup shown in Section 4.1 of the Test Plan. See Figure 12 for the test setup for Terminal D. The single-carrier harmful interference susceptibility levels for this MET are shown in Figure 10. The third-order intermodulation product harmful interference susceptibility levels for this MET are shown in Figure 11. Note that some of the datapoints for MSV's GSM and most of the datapoints for cdma2000 are missing due to test equipment limitations in generating signals strong enough to cause harmful interference to this MET using these modulation techniques.

3.14.2. Figure 10 below shows that the level of the CW signal that causes harmful interference to the Inmarsat Terminal C receiver is about -32 dBm at 1525 MHz. The CW interfering signal level falls to about -42 dBm at 1529 MHz. From about -42 dBm at 1531 MHz, the CW interfering signal level gradually rises to about -32 dBm at 1534 MHz. The CW single-signal interfering level remains in the range of -28 to -35 dBm from 1535 MHz to 1559 MHz, reaching its highest level at 1559 MHz. The simulated MSV's GSM interfering level tracks the CW interfering signal fairly closely except for two unexplained dips at 1539 MHz and 1542 MHz. The simulated cdma2000 interfering signal level was only measurable at 1529 MHz and 1531 MHz because at all other frequencies, the signal generator was unable to output this signal format at a high enough level to cause the BER to degrade to 1×10^{-4}. The level at these two frequencies was about -59 dBm.

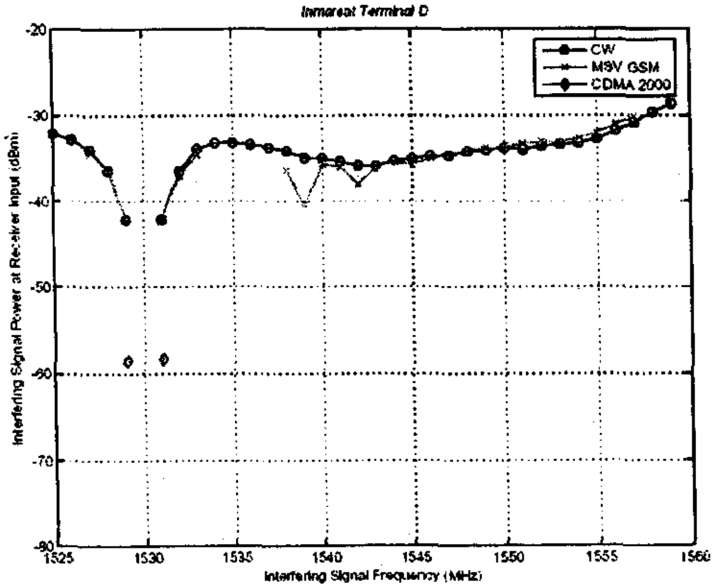

Figure 10: Inmarsat Terminal D Single-Carrier Harmful Interference Levels.

3.14.3. Figure 11 below shows that the combined power level of a pair of CW signals that causes harmful interference due to third-order intermodulation products in the receiver of Inmarsat Terminal D ranges from a low of about -61 dBm to a high of about -53 dBm. The level of the interfering pair of simulated MSV's GSM signals is typically about 3 dB higher than that of the CW signal pair. The level of the interfering pair of simulated cdma2000 signals is typically about 2 dB higher than that of the MSV's GSM signal pair.

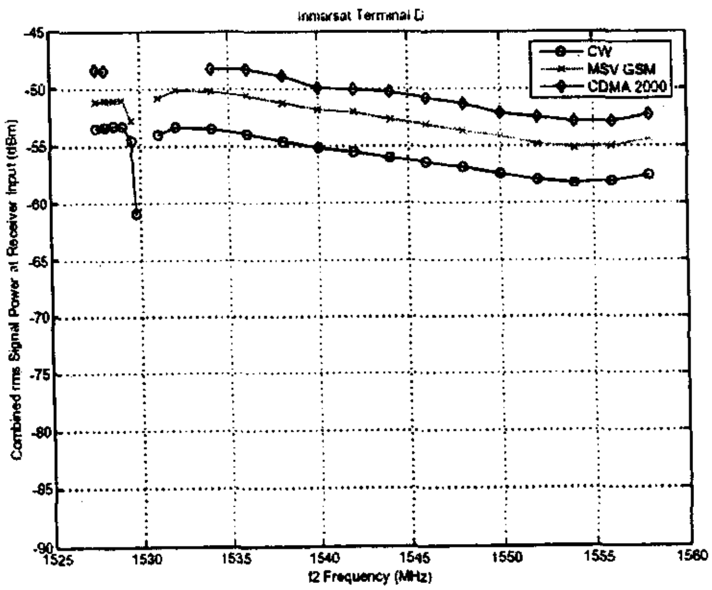

Figure 11: Inmarsat Terminal D Third-Order Intermodulation Product Harmful Interference

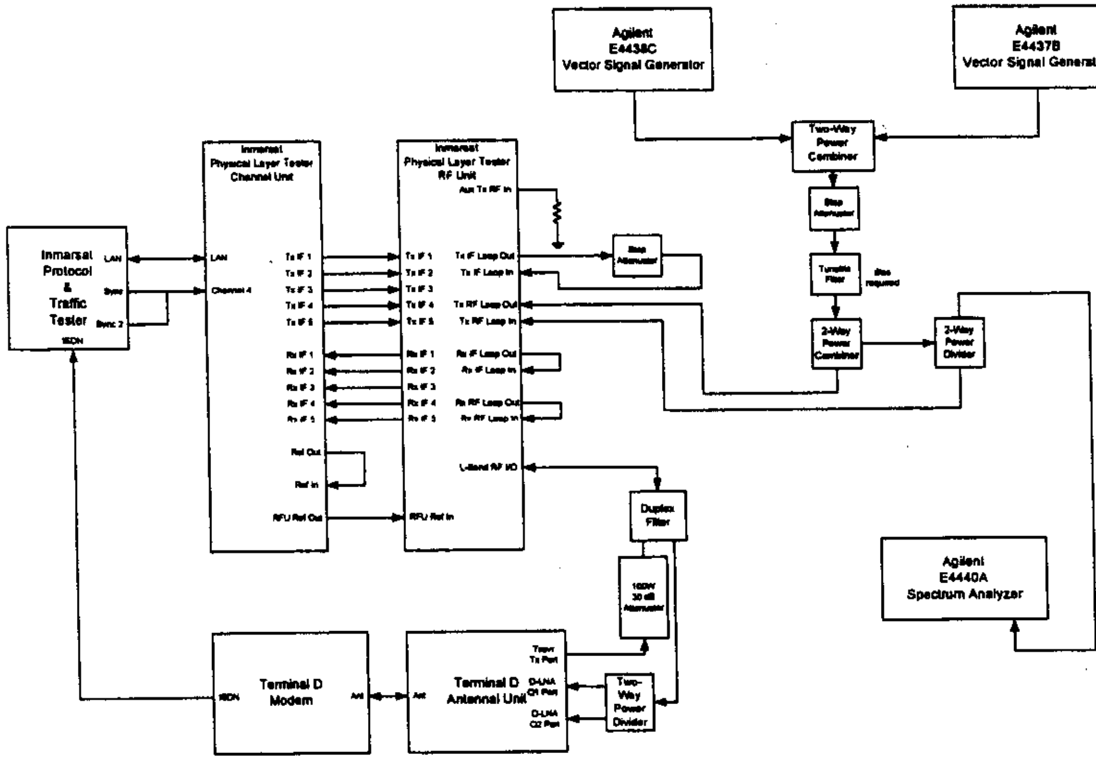

Figure 12: Test Setup for Inmarsat Terminal D

ANNEX 1

TEST PLAN

Inmarsat Terminal
Interference Susceptibility Testing

1. SCOPE

The purpose of the Inmarsat MET interference susceptibility testing is to determine the levels of interference from MSS/ATC Base Stations (BS) that will result in harmful interference to Inmarsat METs. This document defines the methods of determining interference susceptibility of Inmarsat METs submitted to the Federal Communications Commission for interference susceptibility testing.

2. APPLICABLE DOCUMENTS

- Protocol and Traffic Tester Reference Manual, Inmarsat, 28 July 2004
- Physical Layer Tester Hardware Manual, DC-190304 V1.2, Square Peg Communications, Inc., 18 August 2003

3. EQUIPMENT REQUIRED

3.1. Inmarsat-supplied test equipment

- **Physical Layer Tester**
- **Protocol and Traffic Tester**
- **SYNC and RF interconnect cables**

3.2. Commercial Test Equipment

- **Agilent E4438C Vector Signal Generator**
- **Agilent E4437B Vector Signal Generator**
- **Agilent E4440A Spectrum Analyzer**
- **Mini-Circuits ZAPD-2-N Power Combiner/Divider (3 ea.)**
- **0-100 dB Step Attenuator, 0.1 dB steps (2 ea.)**
- **Tunable L-Band Filter**
- **Appropriate RF interconnect cables and adapters**

- **ISDN and LAN interconnect cables**

3.3. Equipment-Under-Test

- **Inmarsat terminals with required accessories**

4. EQUIPMENT SETUP AND INMARSAT RECEIVER OVERLOAD TESTS

4.1. Equipment Setup

Connect the equipment as shown in Figure 1, Equipment Setup Block Diagram. Connect the 100W, 30 dB attenuator (and diplexer, if applicable) to the Inmarsat terminal as recommended by the terminal manufacturer. Connect the tunable filter if/as required.

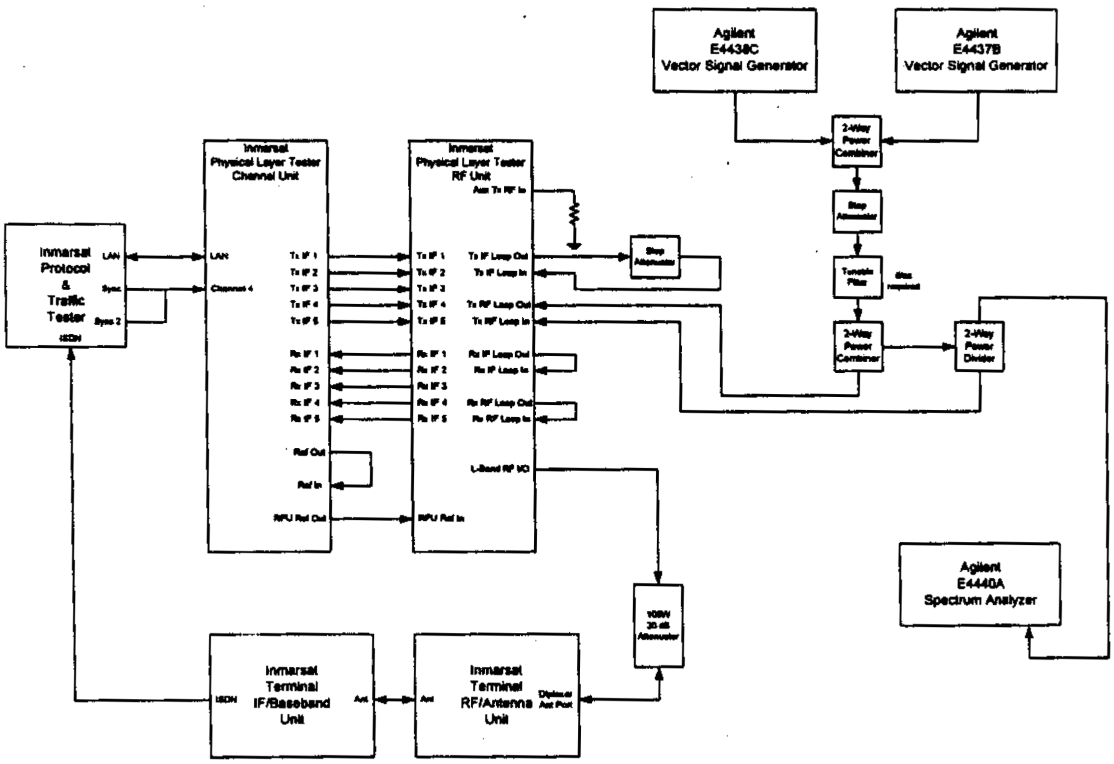

Figure 1: Equipment Setup Block Diagram

4.2. Level Calibration

The purpose of this step is to gather data on the signal level losses through the test setup so that interference levels at the input to the Inmarsat terminal receiver can be easily calculated.

4.2.1. With the step attenuator on the output of the two-way power combiner set to 0 dB, measure and record the power losses from the E4438C vector signal generator and the E4437B vector signal generator through the power dividers/combiners, step attenuator, tunable filter (if used), PLT, and 100W, 30 dB attenuator to the Inmarsat terminal diplexer antenna port over the band 1525 MHz to 1559 MHz.

4.3. Signal Generator Noise Floor Measurement and Compensation

The E4438C and E4437B vector signal generators have a signal-to-noise ratio that varies as a function of modulation type (CW, MSV's GSM, cdma2000) and frequency offset. If the signal generators are required to generate higher-powered signals, the noise floor of the signal generator output within the bandwidth of the desired Inmarsat signal generated by the Inmarsat PLT may be high enough to raise the noise floor at the Inmarsat receiver input and degrade the C/N_0 level of the desired signal.

If this is the case, there are two techniques that can be employed to mitigate the effects of the signal generator noise:

If the frequency offset between the signal generator's simulated interfering signal and the desired signal is high enough, the tunable filter can be employed to reduce the noise level in the bandwidth of the desired signal. If this technique is used, the level calibration described in section 0 will need to include the effects of the tunable filter.

If the frequency offset between the signal generated by the signal generator and the desired signal is small enough so that the tunable filter cannot be used, or if the noise introduced by the signal generator within the bandwidth of the desired signal is relatively low, the desired signal can be increased in power to maintain a constant C/N_0 despite the signal generator noise.

For all tests, monitor the noise floor using the E4440A spectrum analyzer set as follows: Center Frequency: 1529.9 if the interfering signal frequency is less than 1530 MHz, or 1530.1 MHz if the interfering signal frequency is greater than 1530 MHz; Span: 100 kHz; Reference Level: -70 dBm; Attenuator: 0 dB; Measure: Channel Power; Channel Power Integration Bandwidth: 40 kHz. Record the power spectral density measured by the spectrum analyzer with the vector signal generator RF outputs turned off. Monitor the power spectral density that occurs as tests are run, and calculate the resulting increase in the Inmarsat receiver noise floor. As long as the Inmarsat receiver noise floor increases by 1.0 dB or less, it is permissible to increase the power of the Inmarsat signal at 1530 MHz so as to maintain a constant C/N_0 level of the Inmarsat signal. If an increase of more than 1.0 dB is required, determine whether the tunable filter can be used to reduce the signal generator noise at the Inmarsat signal frequency. If neither technique can be used, record this fact and the maximum interfering signal levels that can be attained.

4.4. Baseline minimum desired signal level vs. BER tests

The purpose of this step is to determine the minimum desired signal levels required for the terminal to achieve a bit error rate (BER) of 10^{-5} and 10^{-4}, given the noise floor of the receiver, measured with a minimum of 100 errors.

4.4.1. Set the PTT/PLT for a transmit frequency of 1530 MHz for the carrier against which BER tests will be run. Set the PTT and PLT up to perform BER tests on the Inmarsat terminal. Turn off the RF outputs of the vector signal generators. Set the Tx step attenuator on the PLT and the step attenuator in the Tx IF loopback signal path for a signal level that will result in a C/N_0 about 3 dB higher than that specified by Inmarsat as being required to achieve a BER of 1×10^{-5}.

4.4.2. Start the BER test. Ensure that the terminal synchronizes to the forward-link signal and that the BER is less than 1×10^{-5}.

4.4.3. Reduce the PLT forward-link power until the BER is approximately 1×10^{-5}. Run the test until at least 100 bit errors occur. Fine-tune the forward-link power to achieve the desired BER. Record the step attenuator settings and the measured BER at which this occurs.

4.4.4. Reduce the PL forward-link power until the BER is approximately 1 x 10^{-4}. Run the test until at least 100 bit errors occur. F tune the forward-link power to achieve the desired BER. Record the step attenuator settings a nich this occurs, the measured BER, and the difference between the settings for a BER of approximately 1 x 10^{-5} and a BER of approximately 1 x 10^{-4}.

4.4.5. Increase the forward-link power by 2 dB from the level at which the BER was approximately 1 x 10^{-5}. Maintain this setting except as required by section 4.3.

4.5. Interference tests with a CW signal

The purpose of these tests is to characterize the susceptibility of the Inmarsat MET receiver to harmful interference from a CW (unmodulated carrier) signal over a range of interfering signal frequency offsets and power levels.

4.5.1. Set the E4438C vector signal generator up to generate a CW signal. Set the E4438C frequency to 1525 MHz. Set the output power level of the E4438C to its minimum value, and turn on the RF output. Turn off the RF outputs of the E4437B vector signal generator. Set the step attenuator on the output of the two-way power combiner to 0 dB.

4.5.2. Increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.5.3. Reduce the E4438C output power level by at least 3 dB. Change the E4438C frequency by +1.0 MHz. Then increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.5.4. Repeat the preceding step until the signal generator frequency reaches 1529.0 MHz.

4.5.5. Set the E4438C frequency to 1559 MHz. Set the output power level of the E4438C to its minimum value, and turn on the RF output.

4.5.6. Increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.5.7. Reduce the E4438C output power level by at least 3 dB. Change the E4438C frequency by -1.0 MHz. Then increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.5.8. Repeat the preceding step until the signal generator frequency reaches 1531 MHz.

4.6. Interference tests with a single-carrier simulated GSM signal

The purpose of these tests is to characterize the susceptibility of the Inmarsat MET receiver to harmful interference from MSV's ATC Base Stations transmitting a simulated GSM forward-link signal over a range of interfering signal frequency offsets and power levels.

4.6.1. Set the E4438C vector signal generator up for a simulated GSM signal having the same data rate and time slot structure as a standard GSM signal, but using a 135.40 ksps symbol rate, OQPSK modulation, and a Root-Nyquist baseband filter with alpha = 0.3. Set the E4438C frequency to 1526 MHz. Set the output power level of the E4438C to its minimum value, and turn on the RF output. Turn off the RF outputs of the E4437B vector signal generator. Set the step attenuator on the output of the two-way power combiner to 0 dB.

4.6.2. Increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1×10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.6.3. Reduce the E4438C output power level by at least 3 dB. Change the E4438C frequency by +1.0 MHz. Then increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1×10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.6.4. Repeat the preceding step until the signal generator frequency reaches 1529 MHz.

4.6.5. Set the E4438C frequency to 1558.5 MHz. Set the output power level of the E4438C to its minimum value, and turn on the RF output.

4.6.6. Increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1×10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.6.7. Reduce the E4438C output power level by at least 3 dB. Change the E4438C frequency by -1.0 MHz. Then increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1×10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.6.8. Repeat the preceding step until the signal generator frequency reaches 1531 MHz.

4.7 Interference tests with a simulated single-carrier cdma2000 signal

The purpose of these tests is to characterize the susceptibility of the Inmarsat MET receiver to harmful interference from MSV's ATC Base Stations transmitting a simulated cdma2000 forward-link signal over a range of interfering signal frequency offsets and power levels.

4.7.1. Set the E4438C vector signal generator up for a cdma2000 signal with a 1.25 MHz bandwidth (SR1) and at least nine channels. Set the E4438C frequency to 1526 MHz. Set the output power level of the E4438C to its minimum value, and turn on the RF output. Turn off the RF outputs of the E4437B vector signal generator. Set the step attenuator on the output of the two-way power combiner to 0 dB.

4.7.2. Increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1×10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.7.3. Reduce the E4438C output power level by at least 3 dB. Change the E4438C frequency by +1.0 MHz. Then increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.7.4. Repeat the preceding step until the E4438C frequency reaches 1529 MHz.

4.7.5. Set the E4438C frequency to 1558 MHz. Set the output power level of the E4438C to its minimum value, and turn on the RF output.

4.7.6. Increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.7.7. Reduce the E4438C output power level by at least 3 dB. Change the E4438C frequency by -1.0 MHz. Then increase the output power level of the E4438C until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C frequency and the output power level at which this occurs.

4.7.8. Repeat the preceding step until the E4438C frequency reaches 1531 MHz.

5. THIRD-ORDER INTERMODULATION PRODUCT TESTS

5.1. Purpose

The purpose of these tests is to determine the ptibility of the Inmarsat MET receiver to interference from rd-order intermodulation products fr pairs of MSS ATC BS emissions with frequencies that resul a third-order intermodulation product at the same frequency as the desired Inmarsat space-to-Earth signal.

5.2. Equipment Setup

For these tests, the equipment is set up the same way as is shown in Figure 1 above. The two signal generators will each be set to provide a 0 dBm signal at the output of the two-way power combiner. Level calibration data from paragraph 0 can be used. The noise compensation technique described in paragraph 0 should be used, except that the tunable filter should not be used.

5.3. CW Third-Order Intermodulation Product Tests

The purpose of these tests is to characterize the susceptibility of the Inmarsat MET receiver to harmful interference from a pair of CW (unmodulated carrier) signals at pairs of frequencies that result in third-order intermodulation products at the same frequency as the Inmarsat signal (1530 MHz).

5.3.1. Set the E4438C and E4437B vector signal generators up to generate a CW signal. Set the E4438C frequency to 1538 MHz, and the E4437B frequency to 1546 MHz. Turn off the RF output of the other E4437B vector signal generator. Disconnect the output of the two-way power combiner from the step attenuator and connect the spectrum analyzer to the output of the two-way power combiner. Set the power level of the two vector signal generators such that the rms power level at the output of the tw ay power combiner is 0 dBm for each signal. Set the step attenuator to provide at least 90 dB attenuation, and reconnect the equipment as shown in Figure 1.

5.3.2. Set the E4438C frequency to 1525 MHz, and the E4437B frequency to 1527.5 MHz. Reduce the step attenuator setting until the Inmarsat terminal BER increases to approximately 1 x 10^{-4}. Record the E4438C and E4437B frequencies and the output power level at which this occurs.

5.3.3. Repeat the preceding step for each of the following pairs of frequencies (all in MHz):

1526 , 1528	1530.25, 1530.5
1527, 1528.5	1530.5, 1531
1528, 1529	1531, 1532
1529, 1529.5	1532, 1534
1529.5, 1529.75	1533, 1536
1534, 1538	1540, 1550
1535, 1540	1541, 1552
1536, 1542	1542, 1554
1537, 1544	1543, 1556
1538, 1546	1544, 1558
1539, 1548	

5.4. MSV's GSM Third-Order Intermodulation Product Tests

The purpose of these tests is to characterize the susceptibility of the Inmarsat MET receiver to harmful interference from a pair of MSV's GSM signals at pairs of frequencies that result in third-order intermodulation products at the same frequency as the Inmarsat signal (1530 MHz).

5.4.1. Set the E4438C and E4437B vector signal generators up to generate a GSM signal with OQPSK modulation, Root-Nyquist baseband filtering with alpha = 0.3, and a symbol rate of 135.44 ksps. Set the E4438C frequency to 1538 MHz, and the E4437B frequency to 1546 MHz. Turn off the RF output of the other E4437B vector signal generator. Disconnect the output of the two-way power combiner from the step attenuator and connect the spectrum analyzer to the output of the two-way power combiner. Set the power level of the two vector signal generators such that the rms power level at the output of the two-way power combiner is 0 dBm for each signal. Set the step attenuator to provide at least 90 dB of attenuation, and reconnect the equipment as shown in Figure 1.

5.4.2. Set the E4438C frequency to 1525 MHz, and the E4437B frequency to 1527.5 MHz. Reduce the step attenuator setting until the Inmarsat terminal BER increases to approximately 1×10^{-4}. Record the E4438C and E4437B frequencies and the output power level at which this occurs. Then increase the step attenuator setting by at least 10 dB.

5.4.3. Repeat the preceding step for each of the following pairs of frequencies (all in MHz):

1526 , 1528	1535, 1540
1527, 1528.5	1536, 1542
1528, 1529	1537, 1544
1529, 1529.5	1538, 1546
1530.5, 1531	1539, 1548
1531, 1532	1541, 1552
1532, 1534	1542, 1554
1533, 1536	1543, 1556
1534, 1538	1544, 1558

5.5. cdma2000 Third-Order Intermodulation Product Tests

The purpose of these tests is to characterize the susceptibility of the Inmarsat MET receiver to harmful interference from a pair of cdma2000 signals at pairs of frequencies that result in third-order intermodulation products at the same frequency as the Inmarsat signal (1530 MHz).

5.5.1. Set the E4438C up to generate a single-carrier nine-channel cdma2000 signal, and the E4437B vector signal generator up to generate a single-carrier 32-channel IS-95A signal. Set the E4438C frequency to 1538 MHz, and the E4437B frequency to 1546 MHz. Turn off the RF output of the other E4437B vector signal generator. Disconnect the output of the two-way power combiner from the step attenuator and connect the spectrum analyzer to the output of the two-way power combiner. Set the power level of the two vector signal generators so that the rms power level at the output of the two-way power combiner is 0 dBm for each signal. Set the step attenuator to provide at least 90 dB of attenuation, and reconnect the equipment as shown in Figure

5.5.2. Set the E4438C frequency to 1525 MHz, and the E4437B frequency to 1527.5 MHz. Reduce the step attenuator setting until the Inmarsat terminal BER increases to approximately 1×10^{-4}. Record the E4438C and E4437B frequencies and the output power level at which this occurs. Then increase the step attenuator setting by at least 10 dB.

5.5.3. Repeat the preceding step for each of the following pairs of frequencies (all in MHz):

1526 , 1528	1538, 1546
1527, 1528.5	1539, 1548
1532, 1534	1540, 1550
1533, 1536	1541, 1552
1534, 1538	1542, 1554
1535, 1540	1543, 1556
1536, 1542	1544, 1558
1537, [illegible]4	

APPENDIX B

Final Rules

For the reasons discussed above, the Federal Communications Commission amends 47 C.F.R. part 25 as follows:

PART 25 – SATELLITE COMMUNICATIONS

1. The authority citation for Part 25 continues to read as follows:

Authority: 47 U.S.C. 701-744. Interprets or applies Sections 4, 301, 302,303, 307, 309 and 332 of the Communications Act, as amended, 47 U.S.C. Sections 154, 301, 302, 303, 307, 309, 332, unless otherwise noted.

2. Section 25.149 is amended by revising paragraph (a)(1) to read as follows:

§ 25.149 Application requirements for ancillary terrestrial components in the mobile-satellite service networks operating in the 1.5/1.6 GHz, 1.6/2.4 GHz and 2 GHz mobile-satellite service.

(a) * * *

(1) ATC shall be deployed in the forward-band mode of operation whereby the ATC mobile terminals transmit in the MSS uplink bands and the ATC base stations transmit in the MSS downlink bands in portions of the 2000-2020 MHz/2180-2200 MHz bands (2 GHz band), the 1626.5-1660.5 MHz/1525-1559 MHz bands (L-band), and the 1610-1626.5 MHz/2483.5-2500 MHz bands (Big LEO band).

Note to § 25.149(a)(1):

An L-band MSS licensee is permitted to apply for ATC authorization based on a non-forward-band mode of operation provided it is able to demonstrate that the use of a non-forward-band mode of operation would produce no greater potential interference than that produced as a result of implementing the rules of this section.

* * * * *

3. Section 25.149 is amended by revising paragraph (b)(1)(i) to read as follows:

§ 25.149 Application requirements for ancillary terrestrial components in the mobile-satellite service networks operating in the 1.5/1.6 GHz, 1.6/2.4 GHz and 2 GHz mobile-satellite service.

* * * * *

(b) * * *

(1) * * *

(i) For the 2 GHz MSS band, an applicant must demonstrate that it can provide space-segment service covering all 50 states, Puerto Rico, and the U.S. Virgin Islands one-hundred percent of the time, unless it is not technically possible, consistent with the coverage requirements for 2 GHz MSS GSO operators.

* * * * *

3. Section 25.201 is amended by revising the following definition to read as follows:

§ 25.201 Definitions

* * * * *

Ancillary terrestrial component. The term "ancillary terrestrial component" means a terrestrial communications network used in conjunction with a qualifying satellite network system authorized pursuant to these rules and the conditions established in the Orders issued in IB Docket No. 01-185, *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band.*

4. Section 25.216 is amended by revising paragraph (i) to read as follows:

§ 25.216 Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service.

* * * * *

(i) The e.i.r.p density of carrier-off state emissions from mobile earth stations manufactured more than six months after Federal Register publication of the rule changes adopted in FCC 03-283 with assigned uplink frequencies between 1 and 3 GHz shall not exceed –80 dBW/MHz in the 1559-1610 MHz band averaged over any two millisecond interval.

5. Section 25.252 is amended by revising paragraph (a)(7) and (b)(3) as follows:

§ 25.252 Special requirements for ancillary terrestrial components operating in the 2000–2020 MHz/2180–2200 MHz bands.

(a) * * *

(7) Generate EIRP density, averaged over any two millisecond active transmission interval, greater than –70 dBW/MHz in the 1559–1610 MHz band. The EIRP, measured over any two millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such base stations, shall not exceed –80 dBW in the 1559-1610 MHz band. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

* * * * *

(b) * * *

(3) Not generate EIRP density, averaged over any two-millisecond active transmission interval, greater than –70 dBW/MHz in the 1559-1610 MHz band. The EIRP, measured over any two-millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such mobile

terminals shall not exceed –80 dBW in the 1559-1610 MHz band. The EIRP density of carrier-off-state emissions from such mobile terminals shall not exceed –80 dBW/MHz in the 1559-1610 MHz band, averaged over a two-millisecond interval. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

* * * * *

6. Section 25.253 is amended in its entirety to read as follows:

§ 25.253 Special requirements for ancillary terrestrial components operating in the 1626.5-1660.5 MHz/1525-1559 MHz bands.

(a) An ancillary terrestrial component in these bands shall:

(1) In any band segment coordinated for the exclusive use of an MSS Applicant within the land area of the U.S., where there is no other L-Band MSS satellite making use of that band segment within the visible portion of the geostationary arc as seen from the ATC coverage area, the ATC system will be limited by the in-band and out-of-band emission limitations contained in this section and the requirement to maintain a substantial MSS service.

(2) In any band segment that is coordinated for the shared use of the Applicant's MSS system and another MSS operator, where the coordination agreement existed prior to February 10, 2005 and permits a level of interference to the other MSS system of less than 6% $\Delta T/T$, the Applicant's combined ATC and MSS operations shall increase the system noise level of the other MSS to no more then 6% $\Delta T/T$. Any future coordination agreement between the parties governing ATC operation will supersede this paragraph.

(3) In any band segment that is coordinated for the shared use of the Applicant's MSS system and another MSS operator, where a coordination agreement existed prior to February 10, 2005 and permits a level of interference to the other MSS system of 6% $\Delta T/T$ or greater, the Applicant's ATC operations may increase the system noise level of the other MSS system by no more than an additional 1% $\Delta T/T$. Any future coordination agreement between the parties governing ATC operations will supersede this paragraph.

(4) In a band segment in which the Applicant has no rights under a coordination agreement, the Applicant may not implement ATC in that band.

(b) ATC base stations shall not exceed an out-of-channel emissions measurement of –57.9 dBW/MHz at the edge of a MSS licensee's authorized and internationally coordinated MSS frequency assignment.

(c) An applicant for an ancillary terrestrial component in these bands shall:

(1) Demonstrate, at the time of application, how its ATC network will comply with the requirements of footnotes US308 and US315 to the table of frequency allocations contained in § 2.106 of this chapter regarding priority and preemptive access to the L-band MSS spectrum by the aeronautical mobile-satellite en-route service (AMS(R)S) and the global maritime distress and safety system (GMDSS).

(2) Coordinate with the terrestrial CMRS operators prior to initiating ATC transmissions when co-locating ATC base stations with terrestrial commercial mobile radio service (CMRS) base stations that make use of Global Positioning System (GPS) time-based receivers.

(3) Provide, at the time of application, calculations that demonstrate the ATC system conforms to the ΔT/T requirements in subparagraphs (a)(2) and (a)(3) of this section, if a coordination agreement that incorporates the ATC operations does not exist with other MSS operators.

(d) Applicants for an ancillary terrestrial component in these bands must demonstrate that ATC base stations shall not:

(1) Exceed a peak EIRP of 31.9 -10*log(number of carriers) dBW/200kHz, per sector, for each carrier in the 1525-1541.5 MHz and 1547.5- 1559 MHz frequency bands;

(2) Exceed an EIRP in any direction toward the physical horizon (not to include man-made structures) of 26.9 -10*log(number of carriers) dBW/200 kHz, per sector, for each carrier in the 1525-1541.5 MHz and 1547.5-1559 MHz frequency bands;

(3) Exceed a peak EIRP of 23.9 -10*log(number of carriers) dBW/200 kHz, per sector, for each carrier in the 1541.5-1547.5 MHz frequency band;

(4) Exceed an EIRP toward the physical horizon (not to include man-made structures) of 18.9 - 10*log(number of carriers) dBW/200 kHz, per sector, for each carrier in the 1541.5-1547.5 MHz frequency band;

(5) Exceed a total power flux density level of –56.8 dBW/m^2/200 kHz at the edge of all airport runways and aircraft stand areas, including takeoff and landing paths from all carriers operating in the 1525-1559 MHz frequency bands. The total power flux density here is the sum of all power flux density values associated with all carriers in a sector in the 1525-1559 MHz frequency band, expressed in dB(Watts/m^2/200 kHz). Free-space loss must be assumed if this requirement is demonstrated via calculation;

(6) Exceed a total power flux density level of –56.6 dBW/ m^2/200 kHz at the water's edge of any navigable waterway from all carriers operating in the 1525-1541.5 MHz and 1547.5-1559 MHz frequency bands. The total power flux density here is the sum of all power flux density values associated with all carriers in a sector in the 1525-1541.5 MHz and 1547.5-1559 MHz frequency bands, expressed in dB(Watts/m^2/200 kHz). Free-space loss must be assumed if this requirement is demonstrated via calculation;

(7) Exceed a total power flux density level of –64.6 dBW/ m^2/200 kHz at the water's edge of any navigable waterway from all carriers operating in the 1541.5-1547.5 MHz frequency band. The total power flux density here is the sum of all power flux density values associated with all carriers in a sector in the 1541.5-1547.5 MHz frequency band, expressed in dB(Watts/m^2/200 kHz). Free-space loss must be assumed if this requirement is demonstrated via calculation;

(8) Exceed a peak antenna gain of 16 dBi;

(9) Generate EIRP density, averaged over any two-millisecond active transmission interval, greater than –70 dBW/MHz in the 1559–1605 MHz band or greater than a level determined by linear interpolation in the 1605–1610 MHz band, from –70 dBW/MHz at 1605 MHz to –46 dBW/MHz at 1610 MHz. The EIRP, averaged over any two-millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such base stations shall not exceed –80 dBW in the 1559–1605 MHz band or exceed a level determined by linear interpolation in the 1605-1610 MHz band, from –80 dBW at 1605 MHz to –56 dBW at 1610 MHz. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP

density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

(e) Applicants for an ancillary terrestrial component in these bands must demonstrate, at the time of the application, that ATC base stations shall use left-hand-circular polarization antennas with a maximum gain of 16 dBi and overhead gain suppression according to the following:

Angle from direction of maximum gain, in vertical plane, above antenna (degrees)	Antenna discrimination pattern (dB)
0	Gmax
5	Not to Exceed Gmax -5
10	Not to Exceed Gmax -19
15 to 55	Not to Exceed Gmax -27
55 to 145	Not to Exceed Gmax -30
145 to 180	Not to Exceed Gmax -26

Where: Gmax is the maximum gain of the base station antenna in dBi.

(f) Prior to operation, ancillary terrestrial component licensees shall:

(1) Provide the Commission with sufficient information to complete coordination of ATC base stations with Search-and-Rescue Satellite-Aided Tracking (SARSAT) earth stations operating in the 1544–1545 MHz band for any ATC base station located either within 27 km of a SARSAT station, or within radio horizon of the SARSAT station, whichever is less.

(2) Take all practicable steps to avoid locating ATC base stations within radio line of sight of Mobile Aeronautical Telemetry (MAT) receive sites in order to protect U.S. MAT systems consistent with ITU-R Recommendation ITU-R M.1459. MSS ATC base stations located within radio line of sight of a MAT receiver must be coordinated with the Aerospace and Flight Test Radio Coordinating Council (AFTRCC) for non-Government MAT receivers on a case-by-case basis prior to operation. For government MAT receivers, the MSS licensee shall supply sufficient information to the Commission to allow coordination to take place. A listing of current and planned MAT receiver sites can be obtained from AFTRCC for non-Government sites and through the FCC's IRAC Liaison for Government MAT receiver sites.

(g) ATC mobile terminals shall:

(1) Be limited to a peak EIRP level of 0 dBW and an out-of-channel emissions of -67 dBW/4 kHz at the edge of an MSS licensee's authorized and internationally coordinated MSS frequency assignment.

(2) Be operated in a fashion that takes all practicable steps to avoid causing interference to U.S. radio astronomy service (RAS) observations in the 1660–1660.5 MHz band.

(3) Not generate EIRP density, averaged over any two-millisecond active transmission interval, greater than –70 dBW/MHz in the 1559–1605 MHz band or greater than a level determined by linear interpolation in the 1605–1610 MHz band, from –70 dBW/MHz at 1605 MHz to –46 dBW/MHz at 1610 MHz. The EIRP, averaged over any two-millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such mobile terminals shall not exceed –80 dBW in the 1559–1605 MHz band or exceed a level determined by linear interpolation in the 1605-1610 MHz band, from –80 dBW at 1605 MHz to –56 dBW at 1610 MHz. The EIRP density of carrier-off-state emissions from such mobile terminals shall not exceed –80 dBW/MHz in the 1559–1610 MHz band, averaged over

a two-millisecond interval. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

(h) When implementing multiple base stations and/or base stations using multiple carriers, where any third-order intermodulation product of these base stations falls on an L-band MSS band coordinated for use by another MSS operator with rights to the coordinated band, the MSS ATC licensee must notify the MSS operator. The MSS operator may request coordination to modify the base station carrier frequencies, or to reduce the maximum base station EIRP on the frequencies contributing to the third-order intermodulation products. The threshold for this notification and coordination is when the sum of the calculated signal levels received by an MSS receiver exceeds -70 dBm. The MSS receiver used in these calculations can be assumed to have an antenna with 0 dBi gain. Free-space propagation between the base station antennas and the MSS terminals can be assumed and actual signal polarizations for the ATC signals and the MSS system may be used.

7. Section 25.254 is amended by revising paragraph (a)(4) and (b)(4) as follows:

§ 25.254 Special requirements for ancillary terrestrial components operating in the 1610–1626.5 MHz/2483.5–2500 MHz bands.

(a) * * *

(4) Base stations operating in frequencies above 2483.5 MHz shall not generate EIRP density, averaged over any two-millisecond active transmission interval, greater than –70 dBW/MHz in the 1559–1610 MHz band. The EIRP, averaged over any two-millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such base stations shall not exceed –80 dBW in the 1559–1610 MHz band. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

* * * * *

(b) * * *

(4) ATC mobile terminals operating in assigned frequencies in the 1610-1626.5 MHz band shall not generate EIRP density, averaged over any two-millisecond active transmission interval, greater than –70 dBW/MHz in the 1559–1605 MHz band or greater than a level determined by linear interpolation in the 1605–1610 MHz band, from –70 dBW/MHz at 1605 MHz to –10 dBW/MHz at 1610 MHz. The EIRP, averaged over any two-millisecond active transmission interval, of discrete out-of-band emissions of less than 700 Hz bandwidth from such mobile terminals shall not exceed –80 dBW in the 1559–1605 MHz band or exceed a level determined by linear interpolation in the 1605-1610 MHz band, from –80 dBW at 1605 MHz to –20 dBW at 1610 MHz. The EIRP density of carrier-off-state emissions from such mobile terminals shall not exceed –80 dBW/MHz in the 1559–1610 MHz band, averaged over a two-millisecond interval. A root-mean-square detector function with a resolution bandwidth of one megahertz or equivalent and no less video bandwidth shall be used to measure wideband EIRP density for purposes of this rule, and narrowband EIRP shall be measured with a root-mean-square detector function with a resolution bandwidth of one kilohertz or equivalent.

* * * * *

APPENDIX C: LIST OF COMMENTING PARTIES

Petitions for Reconsideration of the *MSS Flexibility R&O*:
The Boeing Company
The Cellular Telecommunications & Internet Association
Cingular Wireless LLC
Inmarsat Ventures PLC
Mobile Satellite Ventures Subsidiary LLC
The Society of Broadcast Engineers, Inc.
The U.S. GPS Industry Council

Petitions for Reconsideration of the *Sua Sponte Order*:
The Boeing Company

Oppositions to and Comments on Petitions:
Aeronautical Radio, Inc. and the Air Transport Association of America
AT&T Wireless Services, Inc.; Cingular Wireless LLC; Verizon Wireless (the Wireless Carriers)
Delta Air Lines, Inc.
Globalstar, L.P. and Globalstar USA, LLC
ICO Global Communications (Holdings) Limited
Inmarsat Ventures PLC
Mobile Satellite Ventures Subsidiary LLC
The Society of Broadcast Engineers, Inc.

Replies to Oppositions and Comments:
The Cellular Telecommunications & Internet Association
Cingular Wireless LLC
Inmarsat Ventures PLC
Mobile Satellite Ventures Subsidiary LLC
The U.S. GPS Industry Council

***Ex Parte* Comments and Letters:**
Air Trak
AOS, Inc.
American Petroleum Institute/United Telecom Council
Ass'n for Maximum Service Television
The Boeing Company
California Space Authority
The Cellular Telecommunications & Internet Association
Central Communications & Electronics, Inc.
Cingular Wireless LLC
Continental Mobile Communications
The Department of Defense
Geologic Solutions Inc.
GEOSat Solutions, Inc.
Global Communications Solutions Inc.
Globalstar, L.P. and Globalstar USA, LLC
Glocom
Hughes Supply Co.
Inmarsat Ventures PLC
Intel Corporation
International Satellite Services, Inc.

J.E.S. & Sons, Inc.
Level 3 Communications LLC
Mercedes-Benz USA
Mobile Equipment International
Mobile Satellite Ventures Canada Inc.
Mobile Satellite Ventures Subsidiary LLC
Motient, Inc.
National Ass'n of Broadcasters
Nera, Inc.
NexTel, Inc.
Office of Communications of the United Kingdom
Radio-Television News Directors Ass'n
Remote Satellite Systems, International
Satcom Direct
Sky Blitz, Inc.
Space Systems Loral
The Society of Broadcast Engineers, Inc.
Thrane & Thrane Inc.
The U.S. GPS Industry Council
Verizon Wireless
Wells Communications
The Wi-Fi Alliance
Wireless Matrix Corporation

SEPARATE STATEMENT OF
COMMISSIONER MICHAEL J. COPPS
Approving in Part, Concurring in Part

Re: *In the Matter of Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands; IB Docket No. 01-185, IB Docket No. 02-364.*

I agree with today's decision in most respects. I believe that ATC is a vital tool for the MSS industry. It holds the promise of allowing MSS operators to bring improved service and new competition to most of the country through their satellite networks. Satellite has a critically important role to play in bringing the wonders of the digital era to our citizens, especially in hard-to-reach areas. ATC also allows these carriers to serve areas that cannot be reached by satellite through a terrestrial network. I place great stock in the analysis of the FCC's engineers on the interference dispute that we resolve today, and my support of this item is based on their analysis and recommendation.

When we granted ATC authority, however, I argued that the Commission should consider the importance of fees for satellite carriers who choose to use their un-auctioned satellite spectrum licenses for terrestrial uses. We must ensure that the American people are adequately compensated for private use of a public resource and that all spectrum users have the incentive to use spectrum intensively. Because the Commission again fails to do explore spectrum fees, I must concur in part.